Time for action! ICT integration in formal education: Key findings from a region-wide follow-up monitor

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Abstract: This paper is a report on the key findings of a region-wide monitoring study conducted in Dutch-speaking schools in Belgium. First, we elaborate on the building blocks of the instrument, which has been updated and improved since its first deployment in 2007. In particular we focus on the core indicators, along with the multi-actor approach, the sample design and the ways in which new phenomena such as media literacy and gaming have been operationalized. Secondly, we highlight the main trends and patterns within pre-school, primary and secondary education. The first descriptive analyses show quite disappointing results with regard to ICT use at the micro level and the available infrastructure, while headmasters, teachers and pupils reported positive perceptions of different aspects of ICT integration. These results indicate an urgent need to take appropriate action. Therefore, the final part of the paper examines how ICT integration could be improved via structural changes and appropriate policymaking with regard to budgeting, teacher training and the particular role of ICT coordinators in schools.

Introduction

In Belgium, two regional governments are responsible for education policymaking. With regard to the Dutch-speaking schools in Flanders and the Brussels Capital Region the Flemish Ministry of Education and Training decides upon funding schools and running projects, developing attainment targets and assessing whether these are reached. In 2007, cross-curricular objectives concerning the integration of information and communication technology (ICT) in primary and the first level of secondary education were specified by the Flemish government (cf. http://www.ond.vlaanderen.be). Schools autonomously decide how these should be reached. Next to this, one of the anchor points of the Ministry's implementation strategy concerns ICT monitoring research (European Schoolnet, 2009).

Within the European Union, a couple of monitoring instruments are employed for mapping the adoption and diffusion of technology for teaching and learning purposes (European Schoolnet & University of Liège, 2013; Eurydice, 2011; Hakkarainen et al., 2000; Korte & Hüsing, 2006; ten Brummelhuis & van Amerongen, 2011). Such research efforts offer opportunities for policy preparation and evaluation, next to benchmarking and quality improvement (Ossiannilsson, 2011). In Belgium, the Flemish government makes calls for educational policy- and practice-oriented scientific research in order to assess the impact of ICT at all levels of formal education. During the school year 2007-2008 the first ICT Monitor for Flemish Education (MICTIVO) was created and empirically tested (see Evers, Sinnaeve, Clarebout, van Braak & Elen, 2009). Five years later a second optimised and extended monitor has been applied in a wide-scale representative study (MICTIVO2).

In this paper we describe some important findings of this follow-up research. First, we elaborate on the building blocks of the instrument, i.e. the multi-actor approach, along with the core indicators, the sample design and the operationalization of media literacy and gaming. Secondly, we highlight the main patterns with regard to ICT infrastructure, policy, use and perceptions within pre-school, primary and secondary education as compared to five years ago. A third part is dedicated to recommendations with regard to budgeting, teacher training and the particular role of ICT coordinators within schools.

The Monitor for ICT integration

Objectives

MICTIVO 2 seeks an answer to various questions regarding the state of affairs in terms of ICT integration in Flemish education and about related core indicators. It builds fully upon the theoretical insights and empirical findings that were gathered in the first study. In general, the goals of the current monitor can be specified as follows:

1. the further development and validation of the MICTIVO instrument based on a number of new evolutions in ICT and education and based on a number of new policy priorities;
2. the implementation of a large-scale and representative ICT measurement in primary education, secondary education and basic education on the basis of a web survey, and the reporting of results at system level;
3. the implementation and reporting of a comparative analysis based on the results gathered in 2008 and 2012.

Research Framework

MICTIVO maps out ICT integration by means of quantitative research and does this in all types of formal education. The starting point is a scientific model of factors that determine ICT integration. This includes four components: infrastructure and policy, perceptions, competencies and integration at micro-level. The original MICTIVO model from 2007 (see Figure 1) is maintained mainly in order to facilitate a comparison between the different measuring moments. Existing indicators were reviewed again and some indicators were added to conform to other international initiatives regarding ICT monitoring, recent developments in terms of the ICT curriculum in Flemish education, and technological evolutions. The research also takes into account local context characteristics, including the ICT curriculum goals and the importance of school autonomy.

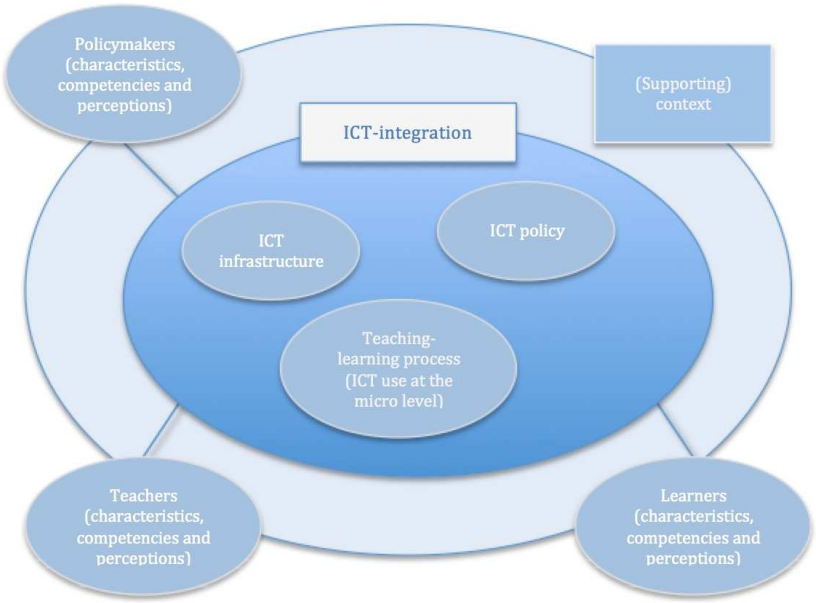

Figure 1: MICTIVO model for ICT integration

Sample Design and Participants

In order to maximize the number of participating schools in elementary and secondary education and keep the organisation of subsets manageable, a specific design was elaborated according to the MICTIVO funnel model with minor adjustments. The design considers the educational institutes as subset units. A proportional stratified random subset of schools was taken from the list of primary and secondary education schools based on institute numbers. The stratification is based on the following population characteristics: educational network, school size and province. Schools who participated in 2008 were first removed from the population file.

Three partial studies were launched. The first partial study (80% of the schools in the subset) only questioned the principal of the school. The second partial study had both the principals and all teachers of the school participating in the survey (10% of the schools in the subset). The board, teachers and students of the school were questioned in the third partial study (10% of the schools in the subset). Students of the fifth and sixth year in primary education participated and students from all years, all types of education and all fields of study in secondary education were questioned. In total 723 headmasters, 2585 teachers and 4887 pupils from 729 institutes participated in the field study (512 schools from primary and 217 schools from secondary education).

Indicators

The MICTIVO model for ICT integration consists of four components, i.e. infrastructure, policy, competencies, use at the micro level and perceptions. These were measured per actor on the basis of 17 indicators, displayed in Table 1:

Table 1: **Overview of the different components and indicators for ICT integration in relation to the questioned actor(s).**

Component and indicators	Principal	Teacher	Student
1. ICT infrastructure and ICT policy			
Presence of hardware	x	x	-
Presence of software	x	x	-
ICT policy	x	x	-
Professional development*	x	x	-
2. ICT competencies			
Computer attitudes	-	x	x
Pedagogic-didactic competencies of teachers	x	x	-
ICT competencies of students	-	x	x
Computer experience	x	x	x
Media literacy*	-	x	x
3. ICT use at the micro level			
ICT use by teachers	x	x	-
ICT use by students	-	x	x
Use of social media*	-	x	x
Use of digital games*	-	x	-
4. ICT perceptions, concerning:			
Importance of ICT for education	x	x	-
The effects of ICT use	x	x	x
ICT infrastructure	x	x	-
ICT continuing education	x	x	-

Note: *new indicator

New indicators include media literacy, the use of social media and digital games for educational purposes, professional development (adapted from Vanderlinde & van Braak, 2010), and ICT usage in pre-school education (based on Kerckaert et al., 2013; in press). The original scale with respect to computer attitudes was adjusted. Media literacy is defined in accordance with the policy document issued by the Flemish Department of Education and Training: 'the unity of knowledge, skills and attitudes necessary for citizens to live consciously and critically in a complex, changing and mediatised society. It is the ability to use the media actively and creatively in a manner that is directed at social participation.' (Lieten & Smet, 2012, p. 10). The scale assesses to what extent students and teachers employ print, audiovisual and computer-based media in an active way, to what degree they are able to gauge opportunities and

risks and to reflect about how the media influence their actions. Digital gaming and social media use for educational purposes was captured on two scales which were developed in line with the remaining indicators for ICT use at the micro level. Both constructs are multifaceted, and evaluate in a detailed manner how, why and to what extent teachers or pupils use digital games and social media during or after class hours, targeting different aims in teaching and learning. For each of the three concepts respondents were presented with a 7-point Likert scales, ranging from 'never' (1) to 'a couple of times a day' (7) with an extra option 'only for a project' (8).

Data Collection and Analysis

An online survey was developed by means of Qualtrics software (cf. http://qualtrics.com/) with maximum parallelism regarding indicators for every actor (cf. supra). The majority of the questions had closed-response alternatives in ordinal rating or Likert scales. For studies 1 and 2 invitations were distributed via personalized e-mails, follow-up telephone calls and letters were sent after one and three weeks, respectively. In the event of non-response, an alternative school with the same sample characteristics was selected. In study 3 two researchers paid visits to the selected schools in Flanders and the Brussels Capital Region. Data were collected between October 12th, 2012 and March 25th, 2013. The questionnaires were taken in one or more classrooms, in the presence of a teacher and a researcher. The survey data were processed using SPSS version 21.

Results in a Nutshell

The following paragraphs summarize a couple of important patterns and trends with regard to ICT integration in the year 2012. For the complete final report, see Pynoo, Kerckaert, Goeman, Elen & van Braak (2013).

Infrastructure and Policy

In general, the European benchmark of 1 computer for 4 pupils is reached in secondary education (Eurydice, 2011). Less than 20% of the schools in primary education reach that benchmark. It is important to note that a large majority of the computers are outdated, especially in primary education and in special secondary education, in which more than half of the computers are more than four years old. If only the number of devices that are less than 4 years old are taken into account, the personal computer (PC) ratio per 100 pupils is: 6.7 (regular primary education), 16.2 (special primary education), 33.0 (regular secondary education) and 12.5 (special secondary education). More than 98% of the pupils, both from primary and secondary education, have access to a computer with internet access at home and increasingly more pupils also have their own computer with internet access - half of the pupils in the third grade of primary education and three out of four students in secondary education.

Schools have invested in interactive whiteboards and to a lesser extent in laptops and other peripherals in the past few years. Three quarters of the schools in regular primary and secondary education have at least one digital blackboard while these are to be found least in special education. A limited number of schools also invested in tablets. E-readers are barely used in Flemish education. Software such as office applications, digital student tracking systems, software specific to the field and/or related to learning methods, mail and chat programs and digital exercises and tests, is present in most of the educational institutes. Both primary and secondary education primarily use commercial software. There are a number of differences between the levels and types of education with regard to the presence of an electronic learning environment (ELO). Only 3% of the educational institutes in regular secondary education do *not*

have an ELO. That is the case for more than a quarter of the schools in special education and 61% in primary education.

An ICT policy plan is present in about three out of four schools. According to the school board, the majority of the schools at all levels are making arrangements about the use of social media and are focusing on online privacy and how students can handle ICT safely. A minority of the schools pursues an explicit stimulation policy with respect to free software. However, a high proportion of the teachers are not aware of one or more topics in the school policy plans. In general, headmasters and teachers have a quite positive attitude towards the quality of the ICT policy. Male teachers in primary education rate the quality of the policy and support more highly than female teachers. They also feel that they are involved more in the purchase of new peripherals or software. Younger teachers from pre-school, primary and secondary education feel more involved in the purchasing policy.

This monitor study also showed us that nearly all regular primary and secondary education schools have an ICT coordinator, who is shared between a group of schools in three quarters of the primary schools and a quarter of the secondary schools. Every school in special primary education has an ICT coordinator who is shared with other schools in two thirds of the cases. As for special secondary education, 88% of the schools have an ICT coordinator who is also shared between a quarter of the schools. The ICT coordinator in Flanders is mainly used for technical support and to maintain and secure the computers. If the ICT coordinator offers didactical support, organises training in ICT or trains the team him/herself, both headmasters and teachers across all different levels of education report significantly higher quality levels in the

policy. These three aspects appear to be important, since teachers who estimate the quality of the ICT policy positively also use more ICT during class. School boards of primary and secondary education and teachers of primary education rate the ICT policy more highly in proportion as their school are allocated more ICT hours.

Competencies and Perceptions

On average, teachers in Flemish education, consider their general competencies in pedagogy and didactics to be sufficient. Only the teachers of regular pre-school education reported lower scores. School boards at all levels of education estimate that, on average, a little over half of their teachers have the required competencies. In particular, the competencies to use ICT when preparing classes and to communicate with students and colleagues are indicated to be well-developed. The teachers themselves feel most competent in these aspects. It is important to note that teachers who find themselves more competent, who have more experience with computers and who feel involved and supported in the purchasing policy, use more ICT during class and when preparing for class. Two obvious patterns emerged for pupils: the younger the pupils, the more positive their attitudes and the older the pupils, the more competent they deem themselves. On average, boys from primary education also deem their general computer competencies to be higher than girls do.

In general, both teachers and students have positive perceptions about the importance and effects of ICT in education. Attitudes with respect to computers in the learning process are more positive in boys from primary and secondary education than in girls. However, it also appears that girls from secondary education have more positive attitudes with respect to computers outside the learning process and also deem their general and emailing competencies to be higher

than boys. These results are somewhat unexpected since it is often assumed that boys think themselves more competent than girls in the field of ICT (Ilomäki, 2011). There appear to be obvious differences between students based on the level of education of the mother as an indicator of socioeconomic status. The higher the education of the mother, the higher students deem their ICT competencies to be. Male teachers score higher than female colleagues on both attitude scales, as well as younger teachers. Additionally, it appears that the more experience teachers have, the more positive their attitudes are. As for the students, boys deem the effects to be greater than the girls do. Students of general secondary education are a little more critical towards the concept of ICT making education better or more attractive.

Usage Patterns at the Micro Level

Students most often use the computer for leisure purposes and much less in class. It is striking that boys from secondary education state that they use the computer more frequently in class than girls while girls have a higher score for using the computer for homework. We found male teachers to be using ICT more often in class than female teachers. Younger teachers use ICT on average more often to prepare classes and during class compared to older colleagues. It appears that teachers of older students in primary education use ICT more than teachers of younger students. ICT teachers in primary education understandably use ICT more before and during class than other teachers.

Both headmasters and teachers indicate that ICT is used more to prepare classes than during classes. In regular pre-school education, nearly a quarter of the teachers never use ICT during class while nearly half of the teachers use ICT only a few times a year in class, primarily to support basic skills and attitudes rather than to introduce learning content and to take care of

individual learning needs. As for regular primary education, about 5% of the teachers never use ICT during class while just under 40% of the teachers use ICT only a few times a year. In other words, just over half of the teachers in primary education use ICT regularly during class. Almost half of the teachers in special primary education use ICT on a regular basis. One teacher out of three in regular secondary education uses ICT regularly in class. As for special secondary education, 40% of the teachers use ICT regularly in class while just over a quarter of the teachers never use ICT in class.

Both social media and digital games have barely been integrated into educational practice to this day. More than half of the teachers in primary and secondary education have never used social media before as part of their professional activity. Students also report using social media to a limited extent for educational purposes.

If media are used, this is predominantly done in a passive manner. Teachers integrate media predominantly for illustrative purposes or to motivate students. Teachers indicate that they use newspapers, magazines, films and slides or pictures most frequently in a passive manner in their teachings. Blogs, soaps and Twitter are used the least. Games are used the least in secondary education. As far as active media use is concerned, teachers report that they most frequently let their students make and edit pictures or let them write an article. It is uncommon for videos to be placed online or edited, a website to be created or Twitter to be used. Furthermore, male teachers appear to be using different media more, both passively and actively. Passive and active media use on the part of teachers is positively correlated to their general ICT use and their competencies in didactics. Teachers who use ICT more and deem themselves more

competent also use different media more in their classes. The extent to which teachers focus on knowledge and attitudes with regard to media literacy, searching skills on the Internet and a higher order of skills is also positively correlated with these factors.

Continuing Education

The number of in-service ICT-oriented professionalisation courses that teachers take is relatively low, on average one to three in the past five years. This number is higher in secondary education (almost three in five years) than in primary education (nearly two in five years on average). The number of ICT-related continuing education courses for headmasters is higher: three to seven in the past five years on average depending on the level of education.

Some Trends

When we take a closer look at the current findings in comparison to the first monitoring study, we may conclude that:

1. More computers are now available per 100 students both in regular primary education and regular secondary education than five years ago;
2. The infrastructure is more outdated than in 2007;
3. Wireless internet and internal networks are now more prominently present in primary education and regular secondary education;
4. The use of computers by pupils from primary and secondary education for homework is higher in 2012 while it is less frequent in classrooms than in the year 2007.
5. Teachers in primary and regular secondary education report that a greater proportion of their students has general computer knowledge and skills. However, this is not consistent with the pupils' self-assessed competencies.

6. Teachers deem themselves to be more competent in their pedagogic-didactic use;
7. Only students and teachers from primary education agree now more strongly that the use of ICT in education results in positive effects. No significant difference is noticed in the case of other actors.
8. Teachers now spend more hours on computer use per week, both for leisure time and professional purposes.
9. ICT use remains low despite two reported contrary trends: according to school boards the ICT use of teachers in the year 2012 was higher than it was five years ago. Teachers at all levels, with the exception of special secondary education, report a higher level of use in class and for assessment purposes, but a lower level of use for preparing classes;
10. Overall, teachers have become less satisfied with the ICT infrastructure and also less satisfied with the offer of technical continuing education;
11. Considerably more ICT policy plans have been in effect at primary schools since 2007, as opposed to secondary education. The quality of the policy is deemed to be more positive by school boards and teachers from primary education and teachers from regular secondary education.
12. Headmasters have higher scores on several indicators i.e. the usage of a computer for leisure and for work purposes, estimation of pupils' ICT use and teachers' competencies. It is striking that school boards in both primary and secondary education are now less satisfied with the offer of technical continued education.

Discussion

State of affairs

The findings of this monitor study demonstrate that all actors agree that ICT deserves an important place in education and can enhance the learning of students. It has also been determined that progress has been made regarding ICT competences and also some aspects of ICT use by teachers in class in the last five years. This progress is statistically meaningful for most levels and types of education. Nevertheless, though the Flemish government has been investing in projects, material equipment and the professional development of teachers and board members in order to incorporate ICTs within education, our findings indicate that in the year 2012 ICT infrastructure was still outdated, teachers and pupils reported low levels of media knowledge, social media use or game usage, and open resources are barely employed. A considerable portion of the teachers continues to use ICT in practice rarely or never. They do so despite the presence of policy plans in most schools and the introduction of specific attainment targets in 2007 for primary education and the first grade of secondary education. Though one would have expected significant progress between 2007 and 2012, the use of ICT for innovative educational purposes is still not widespread. And, while pupils seem to live highly digitized lives, contemporary technologies are seldom employed for teaching or learning at school or at home. These general findings confirm previous conclusions (Punie, Zinnbauer & Cabrera, 2006; Wikan & Molster, 2011).

More specific results of the monitor study are also in line with previous findings of studies in neighbouring countries and Europe. For example, concerning school infrastructure, we notice that investment in primary and secondary education is mainly in interactive whiteboards, just like in the Netherlands. Even so, the PC/pupil ratios are comparable to the results in the 'Vier in Balans' monitor (ten Brummelhuis & van Amerongen, 2011) – the ratio is a little bit

lower in Flemish primary education schools, but higher in secondary education. These ratios are good in comparison with the ratios of other countries in the European Union which are recorded in the report of European Schoolnet (2013), namely between three and seven pupils per computer. According to data of Eurydice in 2009, at least 75% of pupils attend a school with one computer per four or fewer pupils in most European countries (Eurydice, 2011). This standard is reached in Flanders in regular secondary education but not in primary education or special secondary education. The report 'Key Data on Learning and Innovation through ICT at School in Europe 2011' (Eurydice, 2011) states that ICT use at school is a lot less frequent than ICT use at home. Furthermore, it appears that ICT use at home is especially for entertainment and socialization, which confirms previous Finnish research (Samuelsson, 2010). According to the report of European Schoolnet & University of Liège (2013), about half of the students in secondary education use a computer at school at least once a week. Belgium is at the European average with that number. Furthermore, 20% rarely or never use a computer during class. Belgium also scores around the average with this. Additionally, this report showed that students use ICT more often at home for school-related matters than at school itself. Despite the evidence of young people using games and social media applications in their leisure activities, activities, they have not or have barely been introduced into class practice for the time being. This is in accordance with European findings. A teacher in the Netherlands dedicates 15 hours per week on average to computer usage as part of his/her profession. In Flanders, usage averages are lower for any type of education, with values from 7.3 hours/week for teachers in pre-school education to 12.1 hours/week for teachers in secondary education. Three quarters of the teachers in the Netherlands use computers when teaching, while in Flanders these numbers vary depending on the level and type of education.

According to European research, 65 to 80% of the students attend schools that have an ICT coordinator ensuring that pedagogic support is their core task in three quarters of the cases. Teachers and students of schools who have outlined a clearly supportive ICT policy and can fall back on an ICT coordinator have positive attitudes to ICT and use ICT most frequently during classes (European Schoolnet & University of Liège, 2013). The large majority of the questioned schools implements a policy plan with regard to ICT integration, which is a share that is lower than the Netherlands (80%) but higher than the European average (+/- 50%).

Enabling change in ICT integration

The question remains whether the abovementioned trends follow societal evolutions in the field of ICT, and whether they are analogous to the main characteristics of the innovative Information Society as postulated by the European Union since 2000, and four years later by the Flemish government (Goeman, 2006). Given developments in society, schools need to ensure ICT-enabled learning and teaching opportunities for their pupils and personnel. Pupils need to leave school with appropriate functional and critical digital skills, while teachers have to be knowledgeable about the 'how' to reach these goals in a pedagogically sound manner. For their part, headmasters and ICT coordinators can be expected to elaborate a pro-active school strategy and link seamlessly content, technology and services (Henry, 2001) in order to facilitate ICT-based teaching and learning activities. Besides these internal measures, schools could consider strategic alliances with educational publishers and providers of free ICT-enriched materials.

Teacher training

From the monitor study we know that a large portion of the younger teachers never use ICT or only a few times per year in class. This means that it cannot be taken for granted that new teachers who were raised in a digital world and who have just completed teacher training will automatically commit themselves to using ICT in their own teaching practice. Other striking findings include: 1) very low participation rates in ICT-oriented training programmes in the past five years (<1course/year) and 2) low satisfaction rates among teachers and headmasters concerning the technical in-service training. Taking into account the decisive role of teacher training in usage of technologies, it seems important to improve both pre- and in-service programmes with regard to content and delivery method, in order to ensure teachers are better trained for integrating ICT into their teaching.

Such training should aim at empowering teachers to become reflexive professionals, able to cope with future evolutions in educational technology and transformative models of pedagogy. First and foremost teachers need to develop a sense of self-efficacy and to acquire understanding about the educational value of these technologies (Chen, 2010; Wood, Mueller, Willoughby, Specht & Deyoung, 2005). Besides mastery of practical technology skills and an understanding of the pedagogical potential and imperative of ICT integration, they should have knowledge of the subject matter and teaching methodologies in their discipline, and be aware of media trends and the importance of continuous development (International Society for Technology in Education, 2002). Recent meta-etnographical research from Tondeur et al. (2012) has discerned key topics and conditions on two aggregation levels related to successful teacher preparation programmes, which resulted in the Synthesize Qualitative Data (SQD) Model to prepare pre-service teachers for technology use. These authors identified seven themes considered

important for educational technology training i.e. role models, instructional design, reflection, collaboration, authentic experiences and feedback. In their mixed-method study, Ottenbreit-Leftwich et al. (2012) spotted similarities as well as dissimilarities between ICT use types among teachers and the technology topics and practices of teacher education programs. They found evidence that programs should address more the use of interactive technologies, applications for analysing student data and facilitating higher-order thinking skills, e-portfolios. Furthermore, they propose that programs should aim at intensified interactions and co-operation between pre- and in-service teachers, in order to document experiences and demonstrate good practices within a specific school context. Instead of developing an e-portfolio only once, it is recommended to have a continued development of this reflection tool throughout the entire teacher training program. Lastly, these authors are in favour of developing student-centred lesson plans supported by appropriate technology. Polly, Mims, Shepherd & Inan (2010) emphasised the effectiveness of more individualised training and support, based on the results of a systematic document analysis of project outcomes. They found that teachers benefit from the comprehensive focus of technology integration (based on the Technological Pedagogical Content Knowledge or TPACK model) and concrete examples in method courses and field experiences. TPACK was also used as a framework for technology integration in the successful hypermedia environment for self-regulated learning (Kramarski & Michalsky, 2010), while Chen's quantitative research results (2010) confirm Polly et al.'s findings. This scholar concludes: 'the purpose of training is to help pre-service teachers appreciate the value and become aware of the strengths and limitations of ICT and to boost their self-efficacy of teaching with technology, hoping to promote effective use of ICT for students' meaningful learning' and 'efforts to prepare new teachers to use technology effectively should synchronize coursework with field

experiences' (p. 40). Hao Yang (2012) makes a passionate plea to step away from a top-down approach and shift to customized teacher training, which involves good role-modeling and subject-specific guidance. In order to tackle time issues, Gorder (2008) proposes summer schools as a possible means for preparing teachers.

To sum up, it is clear that meaningful and relevant teacher training is rooted in the local context, aimed at acquiring a wide range of skills, showing and sharing experiences to implement specific technologies in one's practice. Some alternative, more effective approaches to class-based 'traditional' pre-service education and in-service training include: (a) summer schools, (b) school-based workshops and projects, (c) mentoring programs and (d) co-design of instructional materials and lesson plans. For both training and, to a lesser extent, some strategic purposes we argue that the current role and responsibilities of the ICT coordinator should be extended a great deal.

The role of the ICT coordinator

Acting as a 'strategic duo', the ICT coordinator, working with the board of a school, ideally formulates and implements specific policy guidelines and support measures with respect to ICT integration (Pelgrum & Anderson, 2001). Taking into account particular aspects of the local context, they refine insights from research about good practices and innovative learning environments, link these with the school's ambitions and show leadership when planning and implementing changes. Via backcasting and roadmaps (Leendertse & Manschot, 2009) they decide upon short-, mid- and long-term goals, expressed in milestones, processes and outcomes of different kinds of technology integration in education (Taylor & Miroiu, 2002). Tasks are defined, responsibilities are assigned, monitoring set up and valorisation of good practices

defined (LeBaron, 2001). Excellent strategic and operational planning and management will make use of ‘sources of strategic funding to set up an institution-wide approach of small but systematic advances building upon existing pockets of excellence.’ claims Sue White (2007, p. 848).

Local support from ICT coordinators seems to be crucial. According to the monitor results, they currently offer mainly technical support, while ideally they are experts in helping teachers create ‘ICT-enabled spaces’ engrafted on six principles: 1) learner centeredness, 2) immersive virtual environments, 3) integrated in daily life, 4) continuous feedback, 5) social interaction and physical components, and 6) open in terms of platforms, channels, services and content (Leendertse & Manschot, 2009). In this regard, ICT coordinators could plug in possibilities for teachers and pupils to ‘bring your own device’ and provide support when designing learning materials and technology-infused lesson plans, either individually or within professional design teams. Also, they can develop local initiatives for customised teacher training in order to keep personnel abreast of educational technology developments (cf. supra).

Recommendations for Action

Given the aforementioned critical issues that were revealed by means of MICTIVO, the Flemish government has to be aware of the fact that formal education regulation with regard to ICT integration does not come up to the mark. Based on the global results and a number of (non-)parametric analyses, we argue that immediate action is necessary. Some structural changes and educational policy adjustments are necessary:

1. **Elaboration of an improved, active stimulation policy at the government level with region-wide guidelines regarding ICT integration in education** so that schools refocus on the role of ICT as a means to make learning and teaching more attractive, efficient and effective. If one wishes for ICT competent and 'media wise' teachers, it seems extremely important to redesign pre-service teacher education, to enhance and intensify professional development activities and to develop several new formats for such training. Given the recent pleas in Europe and Flanders for Open Educational Resources and free software and the existing pitiful state of affairs, it seems expedient to develop specific initiatives to enhance the use of various alternatives for commercial products and closed learning environments. As a 'return on investment', governments could decree that good practices are to be shared in the 'open', a policy which would result in a rich repository of sustainable digital content, courses and objects (Downes, 2007).
2. **Reopening of the debate on specific government-controlled ICT financing for schools**. Currently, formal education is too dependent on resources that have to be allocated to different posts – with the risk of non-investment in ICTs. Dedicated financing should enable schools to purchase more contemporary technologies and to invest more frequently in their update. After all, access to an adequate, well-maintained ICT infrastructure and adjusted software are necessary conditions for educational use of ICT (Pelgrum, 2001).

Conclusions and Future Studies

This paper is a report on the most important findings of a region-wide monitoring study conducted in Dutch-speaking schools in Belgium. First, we elaborated on the building blocks of the instrument, which has been updated and improved since its first deployment in 2007. Second,

we highlighted the main trends and patterns within pre-school, primary and secondary education. The results are quite disappointing with regard to ICT use at the micro level and the available infrastructure, while all actors reported favourable opinions about the application of ICT for educational purposes.

One contribution of this study is the very rich knowledge base that was created with regard to ICT integration of all types and at all levels of formal Dutch-speaking education in Belgium. It allows the government and other stakeholders to assess policymaking and adjust priorities, planning and budgeting in order to tackle critical issues that have been revealed. Thanks to the employed sample design, generalisation of the findings to the whole Flemish region is permitted. As a consequence, the presented region-wide follow-up monitor could be part of larger-scale benchmarking or reviewing, typically issued by the European Union or OECD. A second contribution of the study is related to the multi-actor, multiple-factor research framework. It offers several possibilities for future studies and replication in other contexts. We assert that the MICTIVO model for ICT integration has proven to be a reliable and valid approach for monitoring, and it allows for detailed analyses per subset of indicators or per actor. As such, this study provides information that will be of interest to different scholars.

We acknowledge two important limitations. On the one hand data on pupils' and teachers' competencies are gathered on the basis of self-reporting. In order to avoid bias due to over- or underestimation, future web-based monitoring studies are encouraged to include a virtual performance test, similar to Claro et al. (2012) or Van Deursen & van Diepen (2013), adapted to the European Teachers Competency and Qualifications Framework (eTQF) or the ICT

Competency Framework for Teachers of the United Nations Educational, Scientific and Cultural Organization (UNESCO). Such an objective indicator can complement self-assessments of one's beliefs and skills in using ICT for educational purposes. On the other hand, any school-specific feedback is lacking in the design of the study. Such feedback invites schools to reflect critically and, if desired, adjust local school policy and practices on the basis of objective monitoring and benchmarking information. In this regard, in 2011 Ossiannilsson advocated benchmarking of ICT-enabled learning and this has had a positive impact in five distinct areas: 1) internal processes and involvement, 2) quality enhancement, 3) management and commitment, 4) collaboration and networking, 5) attitudes. During the data collection phase several schools indicated this that has become a necessary condition for them to participate and, if it is absent, a reason for refusal to participate. In order to ensure obtaining representative data in future studies, we recommend providing school feedback as part of the monitor study (van Braak et al., 2010).

Future studies should counter these critiques. In addition, further research will be necessary to verify to what extent changes at the level of the formal ICT curriculum have led to changes in schools' policies and class practice. We look forward to models that specify how individual variables, school context and policy variables interact, and what top-down and bottom-up interventions can improve ICT integration significantly. We would like to emphasise that additional multilevel, cluster and discriminant analyses are necessary in order to answer more profound research questions with regard to typologies of ICT integration and determinants of ICT use at the micro level, taking into account decisive characteristics at the school level.

Finally, qualitative techniques such as focus group interviews are relevant for reviewing the recommendations for action with multiple stakeholders.

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